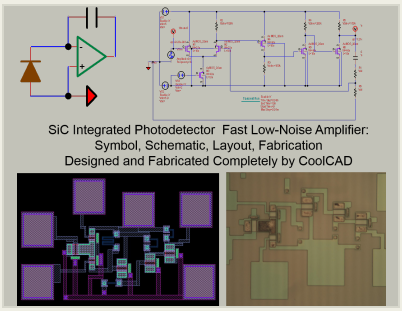
Small Business Innovation Research/Small Business Tech Transfer

A Silicon Carbide Foundry for NASA's UV and High Temperature CMOS Electronics Needs, Phase II

Completed Technology Project (2017 - 2020)

Project Introduction

CoolCAD Electronics has developed a patent-pending technology to design and fabricate Silicon Carbide (SiC) MOSFET opto-electronic integrated circuits (ICs). We both fully design and fabricate these SiC Opto-Electronic ICs in the U.S. using our own design methodologies, SiC process recipes and in-house fabrication facility. We will design, fabricate and test SiC Extreme, Vacuum and Deep Ultraviolet photodetectors. We will prototype PN Junction and Schottky barrier linear photodiodes, as well as low dark count avalanche photodiodes. We will design and fabricate a two-dimensional 256 by 256 passive UV SiC focal plane array. Array elements will be fabricated in-house, out of both PN junction and Schottky barrier detectors, using CoolCAD's process and facilities. We will design and fabricate opto-electronic integrated circuits, where we will integrate various types of detectors with a MOS operational amplifier into a single IC to actively convert the photo current to usable voltage levels. We will also design and fabricate an integrated photodetector and 3-Transistor pixel for active readout. Multiple active pixel readout 3-T circuits will be an array to form a SiC active pixel MOS Deep UV imager. Our in-house fabrication process will also be upgraded. We will automate optical alignment to improve our microfabrication resolution and reduce minimum feature size. We will perform gate oxide anneals to improve carrier mobility. Improving mobility and reducing the minimum feature size will increase MOSFET performance and increase speed of opto-integrated circuits. Furthermore, SiC allows for optoelectronic operation at high temperatures. We will test our circuits up to 500C and utilize special metal contact stacks to enhance high temperature reliability. Finally, we will make our in-house process available to NASA and provide a process development kit for use of our fabrication facility to prototype new application specific SiC integrated circuits.



A Silicon Carbide Foundry for NASA's UV and High Temperature CMOS Electronics Needs, Phase II Briefing Chart Image

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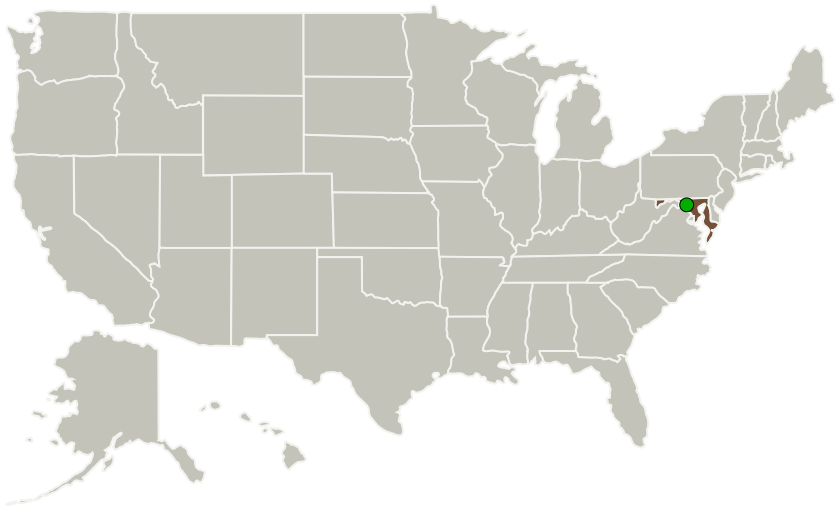
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
CoolCAD Electronics, LLC	Lead Organization	Industry	Takoma Park, Maryland
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CoolCAD Electronics, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

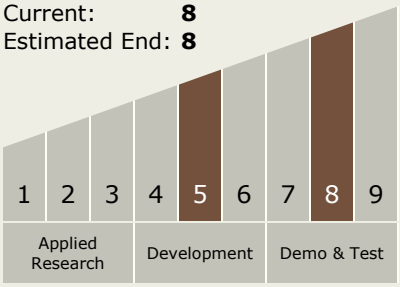
Carlos Torrez

Principal Investigator:

Zeynep Dilli

Technology Maturity (TRL)

Start: **5**
Current: **8**
Estimated End: **8**



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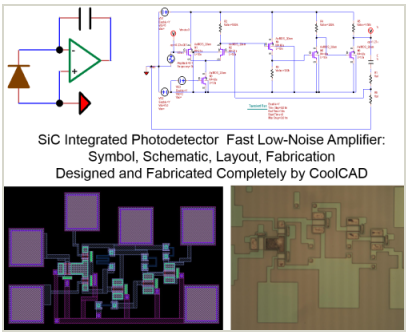
Images



Briefing Chart Image
A Silicon Carbide Foundry for NASA's UV and High Temperature CMOS Electronics Needs, Phase II Briefing Chart Image *(https://techport.nasa.gov/image/129588)*

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.3 Avionics Tools, Models, and Analysis
    - TX02.3.1 Electronics Development Tools

Target Destinations

Earth, The Moon, Mars